87

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/836,281	04/18/2001	Eilon Riess	11927/46001	5466

23838 7590 07/14/2005

KENYON & KENYON
1500 K STREET NW
SUITE 700
WASHINGTON, DC 20005

EXAMINER	
THANGAVELU, KANDASAMY	

ART UNIT	PAPER NUMBER
2123	

DATE MAILED: 07/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/836,281	Applicant(s) RIESS ET AL.
	Examiner Kandasamy Thangavelu	Art Unit 2123

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 April 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-57* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-57* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 April 2001* is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4/18/01, 9/12/01*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☒ Other: *See Continuation Sheet*.

Continuation of Attachment(s) 6). Other: 1449 of 10/11/01, 12/28/01 & 12/13/02.

DETAILED ACTION

1. This communication is in response to the Applicants' Amendment dated April 21, 2005. Claims 1, 2, 9, 10, 14, 19, 23, 24, 29, 30, 40, 44, 45, 49-52, 56 and 57 were amended. Claims 1-57 of the application are pending. This office action is made non-final.

Claim Objections

2. The following is a quotation of 37 C.F.R § 1.75 (d)(1):

> The claim or claims must conform to the invention as set forth in the remainder of the specification and terms and phrases in the claims must find clear support or antecedent basis in the description so that the meaning of the terms in the claims may be ascertainable by reference to the description.

3. Claims 10, 31and 53-55 are objected to because of the following informalities:

Amended Claim 10, Line 4, "adding to a reliability factor based on a value of the sample y_{n-i}" appears to be incorrect and it appears that it should be "adding to a reliability factor a value based on the sample y_{n-i}".

Claim 31, Lines 2-5, "calculating a reliability factor of a candidate sample from values of a plurality of samples in the neighborhood of the candidate sample,

if the reliability factor is below a predetermined limit, designating the candidate sample as a reliable symbol" appears to be incorrect and it appears that it should be "calculating a reliability factor of a captured sample from values of a plurality of samples in the neighborhood of the captured sample,

if the reliability factor is below a predetermined limit, designating the captured sample as a reliable symbol".

Claims 32, 33, 34, 41, 42, 43, 45, 46, 47, 50, 51 and 52 refer to candidate sample; it appears that the reference should be to captured sample.

Claim 53, Lines 3-6, "calculate a reliability factor of a candidate sample from values of a plurality of samples proximate to the candidate sample, and

if the reliability factor is less than a predetermined limit, designate the candidate sample as a reliable symbol" appears to be incorrect and it appears that it should be "calculate a reliability factor of a captured sample from values of a plurality of samples proximate to the captured sample, and

if the reliability factor is less than a predetermined limit, designate the captured sample as a reliable symbol".

Claim 54, Lines 1-6, "The method of claim 53, wherein the reliability factor R_n of the candidate sample is given by:

$R_n = \sum_{i=-k1, i \neq 0}^{k2} | y_{n-i} | c_i$, where

y_n, is the candidate sample,

y_{n-i} is a sample in proximity to the candidate sample,

K_1, K_2 are numbers of samples adjacent to the candidate sample, and

c_i is a coefficient." appears to be incorrect and it appears that it should be "The method of claim 53, wherein the reliability factor R_n of the captured sample is given by:

$R_n = \sum_{i=-k1, i \neq 0}^{k2} | y_{n-i} | c_i$, where

y_n, is the captured sample,

y_{n-i} is a sample in proximity to the captured sample,

K_1, K_2 are numbers of samples adjacent to the captured sample, and

c_i is a coefficient.".

Claim 55, Lines 1-2, "The method of claim 53, wherein the reliability of a two-dimensional candidate sample y_n is given by:" appears to be incorrect and it appears that it should be "The method of claim 53, wherein the reliability of a two-dimensional captured sample y_n is given by:".

Claim 55, Line 5, "K_1, K_2 are numbers of samples adjacent to the candidate sample" appears to be incorrect and it appears that it should be "K_1, K_2 are numbers of samples adjacent to the captured sample".

Appropriate corrections are required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. §112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 29-52, 56 and 57 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably

convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 29 states in part, “the reliable symbols being the captured samples which are estimated to have been corrupted least by intersymbol interference ("ISI")”. The specification does not describe anywhere the method of identifying the captured symbols that have been corrupted least by intersymbol interference.

Claim 30 states in part, “the reliable symbols being the captured samples which are estimated to have been corrupted least by channel effects”. The specification does not describe anywhere the method of identifying the captured symbols that have been corrupted least by channel effects.

Claim 40 states in part, “the detector to estimate which samples from a sequence of captured samples have been corrupted least by channel effects”. The specification does not describe anywhere the method of identifying a sequence of captured symbols that have been corrupted least by channel effects.

Claim 44 states in part, “to identify which of the stored captured samples are likely to have been corrupted least by channel effects”. The specification does not describe anywhere the method of identifying which of the stored captured samples are likely to have been corrupted least by channel effects.

Claim 49 states in part, "the reliable symbols being those captured samples that are estimated to be corrupted least by intersymbol interference". The specification does not describe anywhere the method of identifying captured samples that are estimated to be corrupted least by intersymbol interference.

Claim 56 states in part, "the reliable symbols being the captured samples which are estimated to have been corrupted least by channel effects". The specification does not describe anywhere the method of identifying the captured samples which are estimated to have been corrupted least by channel effects.

Claim 57 states in part, "the reliable symbols being the captured samples which are estimated to have been corrupted least by channel effects". The specification does not describe anywhere the method of identifying the captured samples which are estimated to have been corrupted least by channel effects.

Claims rejected but not specifically addressed are rejected based on their dependency on rejected claims.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claim 6-8, 19 and 54-55 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 6-8 refer to "the predetermined threshold". There is insufficient antecedent basis for the predetermined threshold. Claim 1 refers to “a predetermined limit” and not a predetermined threshold.

Claim 19, Line 5 refers to "the threshold". There is insufficient antecedent basis for the threshold. Claim 19, Line 4 refers to “a predetermined limit” and not a threshold.

Claim 54 recites the limitation " The method of claim 53" in Line 1 of the claim. There is insufficient antecedent basis for this limitation in the claim. Claim 53 refers to “A computer readable medium having stored thereon instructions” and not a method.

Claim 55 recites the limitation " The method of claim 53" in Line 1 of the claim. There is insufficient antecedent basis for this limitation in the claim. Claim 53 refers to “A computer readable medium having stored thereon instructions” and not a method.

Claim Rejections - 35 USC § 101

8. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

9. Claims 1-28, 30-39 and 57 are rejected under 35 U.S.C. 101 because the claimed inventions are directed to non-statutory subject matter.

9.1 Method claims 1-9 are rejected for reciting a method that is not directed to the technological arts.

Regarding claim 1, this claim is directed at a reliable symbol identification method. The claim specifies performing some calculations on already available data and making some decision based on the results. None of the limitations describe any type of computer-implemented steps. To be statutory, the utility of an invention must be within the technological arts. *In re Musgrave*, 167 USPQ 280, 289-90 (CCPA, 1970). The definition of "technology" is the "application of science and engineering to the development of machines and procedures in order to enhance or improve human conditions, or at least to improve human efficiency in some respect." (Computer Dictionary 384 (Microsoft Press, 2d ed. 1994)).

Dependent claims 2-9 depend on Claim 1 but do not add further statutory steps.

The limitations recited in claims 1-9 contain no language suggesting these claims are intended to be within the technological arts.

9.2 Method claims 10-18 are rejected for reciting a method that is not directed to the technological arts.

Regarding claim 10, this claim is directed at a method of identifying reliable symbols. The claim specifies performing some calculations on already available data and making some decision based on the results. None of the limitations describe any type of computer-

implemented steps. To be statutory, the utility of an invention must be within the technological arts. See paragraph 9.1 above.

Dependent claims 11-18 depend on Claim 10 but do not add further statutory steps.

The limitations recited in claims 10-18 contain no language suggesting these claims are intended to be within the technological arts.

9.3 Method claims 19-24 are rejected for reciting a method that is not directed to the technological arts.

Regarding claim 19, this claim is directed at a method of identifying reliable symbols. The claim specifies making some decision based on already available data. None of the limitations describe any type of computer-implemented steps. To be statutory, the utility of an invention must be within the technological arts. See paragraph 9.1 above.

Dependent claims 20-24 depend on Claim 19 but do not add further statutory steps.

The limitations recited in claims 19-24 contain no language suggesting these claims are intended to be within the technological arts.

9.4 Method claims 25-28 are rejected for reciting a method that is not directed to the technological arts.

Regarding claim 25, this claim is directed at a reliable symbol detection method. The claim specifies making some decision based on already available data. None of the limitations describe any type of computer-implemented steps. To be statutory, the utility of an invention must be within the technological arts. See paragraph 9.1 above.

Dependent claims 26-28 depend on Claim 25 but do not add further statutory steps.

The limitations recited in claims 25-28 contain no language suggesting these claims are intended to be within the technological arts.

9.5 Method claims 30-39 are rejected for reciting a method that is not directed to the technological arts.

Regarding claim 30, this claim is directed at an equalization method. The claim specifies performing some calculations on already available data, making some decision based on the results and then performing additional calculations. None of the limitations describe any type of computer-implemented steps. To be statutory, the utility of an invention must be within the technological arts. See paragraph 9.1 above.

Dependent claims 31-39 depend on Claim 30 but do not add further statutory steps.

The limitations recited in claims 30-39 contain no language suggesting these claims are intended to be within the technological arts.

9.6 Claim 57 claims a data signal. A data signal is not a statutory subject matter and therefore cannot be claimed.

10. Claim 1- 9 would be statutory if claim 1 is written as a computer implemented method for identification of a reliable symbol.

Claim 10- 18 would be statutory if claim 10 is written as a computer implemented method of identifying a reliable symbol.

Claim 19- 28 would be statutory if claim 19 is written as a computer implemented method of identifying a reliable symbol.

Claim 30- 39 would be statutory if claim 30 is written as a computer implemented method for equalization of captured samples.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in-
> (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
> (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

12. Claims 1 and 53 are rejected under 35 U.S.C. § 102(e) as being anticipated by **Hassan** (U.S. Patent 5,901,185).

12.1 **Hassan** teaches systems and methods for data augmented pilot-symbol assisted radiotelephone communications. Specifically, as per claim 1, **Hassan** teaches a reliable symbol identification method (CL5, L36-40; CL5, L44-46; CL6, L9-11); comprising:

calculating a reliability factor of a captured sample from values of a plurality of samples in proximity to the captured sample (CL5, L36-40; CL6, L9-11; CL6, L20-24; CL6, L27-30;

CL6, L37-44; CL10, L43-53; calculating the reliability factor is same as calculating the quality criteria or bit error probability);

if the reliability factor is less than a predetermined limit, designating the captured sample as a reliable symbol (CL6, L37-44; CL10, L43-53; designating the captured sample as a reliable symbol is same as designating the captured symbol as having associated error probability less than a predetermined threshold).

12.2 As per Claim 53, it is rejected based on the same reasoning as Claim 1, supra. Claim 53 is a computer readable medium claim reciting the same limitations as Claim 1, as taught throughout by **Hassan.**

13. Claims 19 and 25 are rejected under 35 U.S.C. § 102(e) as being anticipated by **Komatsu** (U.S. Patent 6,560,272).

13.1 As per claim 19, **Komatsu** teaches a method of identifying reliable symbols (CL2, L61-63); comprising, for a captured sample:

determining whether any of a plurality of neighboring sample values is within a predetermined limit (CL4, L10-14; CL4, L52-53);

if none of the values exceed the threshold, designating the captured sample as a reliable symbol (CL4, L10-14; CL4, L54-61).

13.2 As per claim 25, **Komatsu** teaches a reliable symbol detection method (CL2, L61-63); comprising:

identifying a sequence of signal values having values within a predetermined limit (CL4, L10-14; CL4, L52-53);

designating a sample adjacent to the sequence as a reliable symbol (CL4, L10-14; CL4, L54-61).

14. Claims 29, 30, 38, 40, 56 and 57 are rejected under 35 U.S.C. § 102(e) as being anticipated by **Agazzi et al.** (U.S. Patent 5,889,823).

14.1 As per claim 29, **Agazzi et al.** teaches a data decoder (Abstract, L1-3; CL1, L9-12); comprising:

a reliable symbol detector to detect reliable symbols from a sequence of captured samples (CL2, L19-25; CL6, L24-29); the reliable symbols being the captured samples which are estimated to have been corrupted least by intersymbol interference ("ISI") (CL2, L62 to CL3, L4; CL6, L24-29; CL6, L49-53);

an adaptation unit coupled to the reliable symbol detector to generate ISI metrics based on the reliable symbols (CL6, L34-37; CL6, L49-53; CL6, L59-61); and

a data decoder to receive the captured samples and estimate source symbols based on the ISI metrics (CL4, L63 to CL5, L12).

14.2 As per claim 30, **Agazzi et al.** teaches an equalization method (CL6, L34-37; CL6, L59-61; CL3, L6-8); comprising;

identifying reliable symbols from a string of captured samples (CL2, L19-25), the reliable symbols being the captured samples which are estimated to have been corrupted least by channel effects (CL2, L19-25; CL2, L64 to CL3, L4);

calculating channel effects based on the reliable symbols and samples adjacent thereto (CL6, L26-27; CL8, L25-31; CL8, L36-57);

correcting the captured samples based on the channel effects (CL3, L6-8; CL6, L26-27; CL8, L25-31; CL8, L36-57).

14.3 As per claim 38, **Agazzi et al.** teaches the method of claim 30. **Agazzi et al.** teaches wherein the calculating estimates K channel coefficients a_i according to a least squared error analysis of $y_{RS} - x_n\hat{} - \sum_{i=1}^{k} a_i\hat{} x_{n-i}\hat{}$, solving for $a_i\hat{}$ for a plurality of reliable symbols y_{RS}, where $x_n\hat{}$ and $x_{n-i}\hat{}$ are estimated transmitted symbols (CL8, L25-27; CL8 L27-57).

14.4 As per claim 40, **Agazzi et al.** teaches an equalizer, comprising a buffer memory (CL6, L34-37; CL6, L59-61; CL3, L6-8; CL4, L53-54);

a reliable symbol detector in communication with the buffer memory (CL2, L19-25), the detector to estimate which samples from a sequence of captured samples have been corrupted least by channel effects (CL2, L19-25; CL2, L64 to CL3, L4);

an adaptation unit in communication with the reliable symbol detector (CL6, L34-37; CL6, L59-61), to estimate channel effects based on values of the reliable symbols and samples adjacent thereto (CL6, L26-27; CL8, L25-31; CL8, L36-57); and

a symbol decoder in communication with the adaptation unit and the buffer memory (CL4, L53-54; CL4, L63 to CL5, L12).

14.5 As per Claim 56, it is rejected based on the same reasoning as Claim 30, supra. Claim 56 is a computer readable medium claim reciting the same limitations as Claim 30, as taught throughout by **Agazzi et al.**

14.6 As per claim 57, **Agazzi et al.** teaches a data signal, generated according to the process (CL5, L21-23); of

identifying reliable symbols from a string of captured samples (CL2, L19-25), the reliable symbols being the captured samples which are estimated to have been corrupted least by channel effects (CL2, L19-25; CL2, L64 to CL3, L4);

calculating channel effects based on the reliable symbols and samples adjacent thereto (CL8, L25-31; CL8, L36-57);

estimating transmitted symbols from remaining captured samples based on the channel effects (CL3, L6-8; CL8, L25-31; CL8, L36-57); and

outputting the estimated symbols as the data signal (CL5, L21-23).

Claim Rejections - 35 USC § 103

15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

16. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

17. Claims 2-5, 10-12 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Hassan** (U.S. Patent 5,901,185) in view of **Dent** (U.S. Patent 6,347,125).

17.1 As per claims 2-5, **Hassan** teaches the method of claim 1. **Hassan** does not expressly teach that the reliability factor Rn of the candidate sample is given by:

$R_n = \sum_{i=-k1, i \neq 0}^{k2} | y_{n-i} | c_i$, where

y_n, is the candidate sample,

y_{n-i} is a sample in proximity to the candidate sample,

K_1, K_2 are numbers of samples adjacent to the candidate sample, and

c_i is a coefficient ; where $c_i = 1$ for all i; wherein $K_1 = 0$; and wherein $K_2 = 0$. **Dent** teaches that the reliability factor Rn of the candidate sample is given by:

$R_n = \sum_{i=-k1, i\neq 0}^{k2} | y_{n-i} | c_i$, where

y_n, is the candidate sample,

y_{n-i} is a sample in proximity to the candidate sample,

K_1, K_2 are numbers of samples adjacent to the candidate sample, and

c_i is a coefficient; where $c_i = 1$ for all i; wherein $K_1 = 0$; and wherein $K_2 = 0$ (CL4, L30-41), because that allows using the maximum likelihood sequence estimation (MLSE) to hypothesize a sequence of symbol values using channel coefficients as weighting factors to attempt to predict the received samples (CL4, L43-47). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the method of **Hassan** with the method of **Dent** that included the reliability factor Rn of the candidate sample being given by:

$R_n = \sum_{i=-k1, i\neq 0}^{k2} | y_{n-i} | c_i$, where

y_n, was the candidate sample,

y_{n-i} was a sample in proximity to the candidate sample,

K_1, K_2 were numbers of samples adjacent to the candidate sample, and

c_i was a coefficient; where $c_i = 1$ for all i; wherein $K_1 = 0$; and wherein $K_2 = 0$. The artisan would have been motivated because that would allow using the maximum likelihood sequence estimation (MLSE) to hypothesize a sequence of symbol values using channel coefficients as weighting factors to attempt to predict the received samples.

17.2 As per claims 10-12, **Hassan** teaches method of identifying reliable symbols (CL5, L36-40; CL5, L44-46; CL6, L9-11); comprising:

for a candidate sample y_n:

iteratively, for i= - K_1 to K_2, i#0:

if the reliability factor exceeds a predetermined limit, disqualifying the captured sample as a reliable symbol (CL6, L37-44; CL10, L43-53; designating the captured sample as not a reliable symbol is same as designating the captured symbol as not having associated error probability less than a predetermined threshold); and

otherwise, incrementing i and, if i=0, re-incrementing i for a subsequent iteration; thereafter, unless the captured symbol has been disqualified, designating the candidate sample as a reliable symbol (CL6, L37-44; CL10, L43-53; designating the captured sample as a reliable symbol is same as designating the captured symbol as having associated error probability less than a predetermined threshold).

Hassan does not expressly teach that adding to a reliability factor based on a value of the sample y_{n-I}; the adding adds an absolute value of the sample y_{n-i} to the reliability factor; and the adding adds a scaled value of the sample y_{n-i} to the reliability factor, the value scaled in accordance with a predetermined coefficient c_i. **Dent** teaches that adding to a reliability factor based on a value of the sample y_{n-I}; the adding adds an absolute value of the sample y_{n-i} to the reliability factor; and the adding adds a scaled value of the sample y_{n-i} to the reliability factor, the value scaled in accordance with a predetermined coefficient c_i (CL4, L30-41), because that allows using the maximum likelihood sequence estimation (MLSE) to hypothesize a sequence of

symbol values using channel coefficients as weighting factors to attempt to predict the received samples (CL4, L43-47). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the method of **Hassan** with the method of **Dent** that included adding to a reliability factor based on a value of the sample y_{n-I}; the adding of an absolute value of the sample y_{n-i} to the reliability factor; and the adding of a scaled value of the sample y_{n-i} to the reliability factor, the value scaled in accordance with a predetermined coefficient c_i. The artisan would have been motivated because that would allow using the maximum likelihood sequence estimation (MLSE) to hypothesize a sequence of symbol values using channel coefficients as weighting factors to attempt to predict the received samples.

17.3 As per Claim 54, it is rejected based on the same reasoning as Claim 2, supra. Claim 54 is a computer readable medium claim reciting the same limitations as Claim 2, as taught throughout by **Hassan** and **Dent.**

18. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Hassan** (U.S. Patent 5,901,185) in view of **Kaasila et al.** (U.S. Patent 6,717,934).

18.1 As per claim 6, **Hassan** teaches the method of claim 1. **Hassan** does not expressly teach that the predetermined threshold varies over time. **Kaasila et al.** teaches that predetermined threshold varies over time (CL3, L61-65; the threshold is varied as a function of noise which varies over time), because that allows determining the magnitude of detection error between the transmitted symbol sequence and the detected symbols and calculating a mean of the detection

error powers, comparing the calculated mean of the detection error powers with the threshold value and selecting a modulation type based on the result of comparing (CL3, L56-60). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the method of **Hassan** with the method of **Kaasila et al.** that included predetermined threshold varying over time. The artisan would have been motivated because that would allow determining the magnitude of detection error between the transmitted symbol sequence and the detected symbols and calculating a mean of the detection error powers, comparing the calculated mean of the detection error powers with the threshold value and selecting a modulation type based on the result of comparing.

19. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Hassan** (U.S. Patent 5,901,185) in view of **Dent** (U.S. Patent 6,347,125), and further in view of **Kaasila et al.** (U.S. Patent 6,717,934).

19.1 As per claim 13, **Hassan** and **Dent** teach the method of claim 10. **Hassan** does not expressly teach that the adding adds the power of the sample y_{n-i} to the reliability factor. **Kaasila et al.** teaches that the adding adds the power of the sample y_{n-i} to the reliability factor (CL3, L55-56), because that allows determining the magnitude of detection error between the transmitted symbol sequence and the detected symbols and calculating a mean of the detection error powers, comparing the calculated mean of the detection error powers with the threshold value and selecting a modulation type based on the result of comparing (CL3, L56-60). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the

method of **Hassan** with the method of **Kaasila et al.** that included the adding the power of the sample y_{n-i} to the reliability factor. The artisan would have been motivated because that would allow determining the magnitude of detection error between the transmitted symbol sequence and the detected symbols and calculating a mean of the detection error powers, comparing the calculated mean of the detection error powers with the threshold value and selecting a modulation type based on the result of comparing.

20. Claims 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Hassan** (U.S. Patent 5,901,185) in view of **Dent** (U.S. Patent 6,347,125), and further in view of **Isaksson et al.** (U.S. Patent 6,438,174).

20.1 As per claims 14-15, **Hassan** and **Dent** teach the method of claim 10. **Hassan** does not expressly teach that the predetermined limit is half a width of an annular constellation ring in which the captured sample is observed; and the predetermined limit is $(K_1 + K_2)\ d_{min}$, where d_{min} is half a distance between two constellation points that are closest together in a governing constellation. **Isaksson et al.** teaches that the predetermined limit is half a width of an annular constellation ring in which the captured sample is observed; and the predetermined limit is $(K_1 + K_2)\ d_{min}$, where d_{min} is half a distance between two constellation points that are closest together in a governing constellation (CL2, L49-51; CL3, L1-2; CL20, L53-57), because that allows the system to be adapted to determine a parameter for each carrier, the parameter being indicative of a deviation of the received signal from the corresponding constellation point (Abstract, L6-12). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention

to modify the method of **Hassan** with the method of **Isaksson et al.** that included the predetermined limit is half a width of an annular constellation ring in which the captured sample is observed; and the predetermined limit is $(K_1 + K_2)\ d_{min,}$ where d_{min} is half a distance between two constellation points that are closest together in a governing constellation. The artisan would have been motivated because that would allow the system to be adapted to determine a parameter for each carrier, the parameter being indicative of a deviation of the received signal from the corresponding constellation point.

21. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Hassan** (U.S. Patent 5,901,185) in view of **Dent** (U.S. Patent 6,347,125), and further in view of **Kaasila et al.** (U.S. Patent 6,717,934).

21.1 As per claim 16, **Hassan** and **Dent** teach the method of claim 10. **Hassan** does not expressly teach that the predetermined limit varies over time. **Kaasila et al.** teaches that predetermined limitvaries over time (CL3, L61-65; the threshold is varied as a function of noise which varies over time). The motivation for combining the method of **Hassan** with the method of **Kaasila et al.** is presented in Paragraph 18.1 above.

22. Claims 20 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Komatsu** (U.S. Patent 6,560,272) in view of **Kaasila et al.** (U.S. Patent 6,717,934).

22.1 As per claim 20, **Komatsu** teaches the method of claim 19. **Komatsu** does not expressly teach that the predetermined limit varies over time. **Kaasila et al.** teaches that predetermined limit varies over time (CL3, L61-65; the threshold is varied as a function of noise which varies over time), because that allows determining the magnitude of detection error between the transmitted symbol sequence and the detected symbols and calculating a mean of the detection error powers, comparing the calculated mean of the detection error powers with the threshold value and selecting a modulation type based on the result of comparing (CL3, L56-60). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the method of **Komatsu** with the method of **Kaasila et al.** that included predetermined limit varying over time. The artisan would have been motivated because that would allow determining the magnitude of detection error between the transmitted symbol sequence and the detected symbols and calculating a mean of the detection error powers, comparing the calculated mean of the detection error powers with the threshold value and selecting a modulation type based on the result of comparing.

22.2 As per claim 26, **Komatsu** teaches the method of claim 25. **Komatsu** does not expressly teach that the predetermined threshold varies over time. **Kaasila et al.** teaches that predetermined limit varies over time (CL3, L61-65; the threshold is varied as a function of noise which varies over time). The motivation for combining the method of **Komatsu** with the method of **Kaasila et al.** is presented in Paragraph 22.1 above.

23. Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Komatsu** (U.S. Patent 6,560,272) in view of **Temerinac** (U.S. Patent 6,477,215).

23.1 As per claims 23 and 24, **Komatsu** teaches the method of claim 19. **Komatsu** does not expressly teach that the neighboring samples occur in a first window adjacent to the candidate sample on one side of the candidate sample; and the neighboring symbols occur in a pair of windows that are adjacent to, and on either side of the candidate sample. **Temerinac** teaches that the neighboring samples occur in a first window adjacent to the candidate sample on one side of the candidate sample; and the neighboring symbols occur in a pair of windows that are adjacent to, and on either side of the candidate sample (CL4, L13-24), because if the window extends over several successive symbols or the associated sample values, a very effective reliability value can be determined by a simple logic operation (CL4, L21-24). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the method of **Komatsu** with the method of **Temerinac** that included the neighboring samples occurring in a first window adjacent to the candidate sample on one side of the candidate sample; and the neighboring symbols occurring in a pair of windows that would be adjacent to, and on either side of the candidate sample. The artisan would have been motivated because if the window extended over several successive symbols or the associated sample values, a very effective reliability value could be determined by a simple logic operation.

24. Claims 31 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Agazzi et al.** (U.S. Patent 5,889,823) in view of **Hassan** (U.S. Patent 5,901,185).

24.1 As per claim 31, **Agazzi et al.** teaches the method of claim 30. **Agazzi et al.** does not expressly teach calculating a reliability factor of a candidate sample from values of a plurality of samples in the neighborhood of the candidate sample; and if the reliability factor is below a predetermined limit, designating the candidate sample as a reliable symbol. **Hassan** teaches calculating a reliability factor of a candidate sample from values of a plurality of samples in the neighborhood of the candidate sample (CL5, L36-40; CL6, L9-11; CL6, L20-24; CL6, L27-30; CL6, L37-44; CL10, L43-53; calculating the reliability factor is same as calculating the quality criteria or bit error probability); and if the reliability factor is below a predetermined limit, designating the candidate sample as a reliable symbol (CL6, L37-44; CL10, L43-53; designating the captured sample as a reliable symbol is same as designating the captured symbol as having associated error probability less than a predetermined threshold), because that allows estimation of a group of symbols from a group of information symbol data and previous estimates of channel characteristic and identification of group of estimated symbols that have an associated error probability less than a predetermined threshold (CL6, L39-44). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the method of **Agazzi et al.** with the method of **Hassan** that included calculating a reliability factor of a candidate sample from values of a plurality of samples in the neighborhood of the candidate sample; and if the reliability factor is below a predetermined limit, designating the candidate sample as a reliable symbol. The artisan would have been motivated because that would allow estimation of a group of symbols from a group of information symbol data and previous

estimates of channel characteristic and identification of group of estimated symbols that would have an associated error probability less than a predetermined threshold.

24.2 As per claim 41, **Agazzi et al.** teaches the equalizer of claim 40. **Agazzi et al.** does not expressly teach the reliable symbol operates according to a method, comprising calculating a reliability factor of a candidate sample from values of a plurality of samples in the neighborhood of the candidate sample; and if the reliability factor is below a predetermined limit, designating the candidate sample as a reliable symbol. **Hassan** teaches calculating a reliability factor of a candidate sample from values of a plurality of samples in the neighborhood of the candidate sample (CL5, L36-40; CL6, L9-11; CL6, L20-24; CL6, L27-30; CL6, L37-44; CL10, L43-53; calculating the reliability factor is same as calculating the quality criteria or bit error probability); and if the reliability factor is below a predetermined limit, designating the candidate sample as a reliable symbol (CL6, L37-44; CL10, L43-53; designating the captured sample as a reliable symbol is same as designating the captured symbol as having associated error probability less than a predetermined threshold). The motivation for modifying the equalizer of **Agazzi et al.** with the method of **Hassan** is presented in Paragraph 24.1 above.

25. Claims 32, 33 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Agazzi et al.** (U.S. Patent 5,889,823) in view of **Hassan** (U.S. Patent 5,901,185), and further in view of **Dent** (U.S. Patent 6,347,125).

25.1 As per claim 32, **Agazzi et al.** and **Hassan** teach the method of claim 31. **Agazzi et al.** does not expressly teach that the reliability factor Rn of the candidate sample is given by:

$R_n = \sum_{i=-k1, i\neq 0}^{k2} | y_{n-i} | c_i$, where

y_n, is the candidate sample,

y_{n-i} is a sample in proximity to the candidate sample,

K_1, K_2 are numbers of samples adjacent to the candidate sample, and

c_i is a coefficient i. **Dent** teaches that the reliability factor Rn of the candidate sample is given by:

$R_n = \sum_{i=-k1, i\neq 0}^{k2} | y_{n-i} | c_i$, where

y_n, is the candidate sample,

y_{n-i} is a sample in proximity to the candidate sample,

K_1, K_2 are numbers of samples adjacent to the candidate sample, and

c_i is a coefficient (CL4, L30-41), because that allows using the maximum likelihood sequence estimation (MLSE) to hypothesize a sequence of symbol values using channel coefficients as weighting factors to attempt to predict the received samples (CL4, L43-47). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the method of **Agazzi et al.** with the method of **Dent** that included the reliability factor Rn of the candidate sample being given by:

$R_n = \sum_{i=-k1, i\neq 0}^{k2} | y_{n-i} | c_i$, where

y_n, was the candidate sample,

y_{n-i} was a sample in proximity to the candidate sample,

K_1, K_2 were numbers of samples adjacent to the candidate sample, and

c_i was a coefficient. The artisan would have been motivated because that would allow using the maximum likelihood sequence estimation (MLSE) to hypothesize a sequence of symbol values using channel coefficients as weighting factors to attempt to predict the received samples.

25.2 As per claim 33, **Agazzi et al.** and **Hassan** teach the method of claim 31. **Agazzi et al.** does not expressly teach that the reliability factor Rn of the candidate sample is given by:

$R_n = \sum_{i=1}^{k} | y_{n-i} | c_i$, where

y_{n-i} is a sample in the neighborhood of the candidate sample,

K is a length of samples, and

c_i is a coefficient. **Dent** teaches that the reliability factor Rn of the candidate sample is given by:

$R_n = \sum_{i=1}^{k} | y_{n-i} | c_i$, where

y_{n-i} is a sample in the neighborhood of the candidate sample,

K is a length of samples, and

c_i is a coefficient (CL4, L30-41), because that allows using the maximum likelihood sequence estimation (MLSE) to hypothesize a sequence of symbol values using channel coefficients as weighting factors to attempt to predict the received samples (CL4, L43-47). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the method of **Agazzi et al.** with the method of **Dent** that included the reliability factor Rn of the candidate sample being given by:

$R_n = \sum_{i=1}^{k} | y_{n-i} | c_i$, where

y_{n-i} is a sample in the neighborhood of the candidate sample,

K is a length of samples, and

c_i was a coefficient. The artisan would have been motivated because that would allow using the maximum likelihood sequence estimation (MLSE) to hypothesize a sequence of symbol values using channel coefficients as weighting factors to attempt to predict the received samples.

25.3 As per claim 42, **Agazzi et al.** and **Hassan** teach the equalizer of claim 41. **Agazzi et al.** does not expressly teach that the reliability factor Rn of the candidate sample is given by:

$R_n = \sum_{i=-k1, i \neq 0}^{k2} | y_{n-i} | c_i$, where

y_n, is the candidate sample,

y_{n-i} is a sample in proximity to the candidate sample,

K_1, K_2 are numbers of samples adjacent to the candidate sample, and

c_i is a coefficient i. **Dent** teaches that the reliability factor Rn of the candidate sample is given by:

$R_n = \sum_{i=-k1, i \neq 0}^{k2} | y_{n-i} | c_i$, where

y_n, is the candidate sample,

y_{n-i} is a sample in proximity to the candidate sample,

K_1, K_2 are numbers of samples adjacent to the candidate sample, and

c_i is a coefficient (CL4, L30-41). The motivation for modifying the equalizer of **Agazzi et al.** with the method of **Dent** is presented in Paragraph 25.1 above.

26. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Agazzi et al.** (U.S. Patent 5,889,823) in view of **Komatsu** (U.S. Patent 6,560,272), and further in view of **Hassan** (U.S. Patent 5,901,185).

26.1 As per claim 35, **Agazzi et al.** teaches the method of claim 30. **Agazzi et al.** does not expressly teach identifying a sequence of samples having received signal magnitude levels below a predetermined limit; and designating a sample adjacent to the sequence as a reliable symbol. **Komatsu** teaches identifying a sequence of signal values having values within a predetermined limit (CL4, L10-14; CL4, L52-53); and designating a sample adjacent to the sequence as a reliable symbol (CL4, L10-14; CL4, L54-61), because as per **Hassan** that allows estimation of a group of symbols from a group of information symbol data and previous estimates of channel characteristic and identification of group of estimated symbols that have an associated error probability less than a predetermined threshold (CL6, L39-44). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the method of **Agazzi et al.** with the method of **Komatsu** that included identifying a sequence of samples having received signal magnitude levels below a predetermined limit; and designating a sample adjacent to the sequence as a reliable symbol. The artisan would have been motivated because that would allow estimation of a group of symbols from a group of information symbol data and previous estimates of channel characteristic and identification of group of estimated symbols that would have an associated error probability less than a predetermined threshold.

27. Claims 36 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Agazzi et al.** (U.S. Patent 5,889,823) in view of **Temerinac** (U.S. Patent 6,477,215).

27.1 As per claim 36, **Agazzi et al.** teaches the method of claim 30. **Agazzi et al.** does not expressly teach for QAM transmission, the identifying comprises identifying a sequence of samples for which a received signal magnitude in a quadrature-phase component is below a predetermined limit. **Temerinac** teaches for QAM transmission, the identifying comprises identifying a sequence of samples for which a received signal magnitude in a quadrature-phase component is below a predetermined limit (CL6, L32-41), because the measured phase and amplitude error values represent a measure of respective reliability; smaller the error values, greater the reliability (CL3, L17-19). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the method of **Agazzi et al.** with the method of **Temerinac** that included for QAM transmission, the identifying comprising identifying a sequence of samples for which a received signal magnitude in a quadrature-phase component was below a predetermined limit. The artisan would have been motivated because the measured phase and amplitude error values would represent a measure of respective reliability; smaller the error values, greater the reliability.

Agazzi et al. does not expressly teach designating an adjacent sample as a reliable symbol for quadrature-phase. **Temerinac** teaches designating an adjacent sample as a reliable symbol for quadrature-phase (CL3, L17-26), because the measured phase and amplitude error values represent a measure of respective reliability; smaller the error values, greater the reliability (CL3, L17-19). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the method of **Agazzi et al.** with the method of **Temerinac** that included designating an adjacent sample as a reliable symbol for quadrature-phase. The artisan would have been motivated because the measured phase and

amplitude error values would represent a measure of respective reliability; smaller the error values, greater the reliability.

27.2 As per claim 37, **Agazzi et al.** teaches the method of claim 30. **Agazzi et al.** does not expressly teach for QAM transmission, the identifying comprises identifying a sequence of samples for which a received signal magnitude in an in-phase component is below a predetermined limit. **Temerinac** teaches for QAM transmission, the identifying comprises identifying a sequence of samples for which a received signal magnitude in an in-phase component is below a predetermined limit (CL6, L32-41), because the measured phase and amplitude error values represent a measure of respective reliability; smaller the error values, greater the reliability (CL3, L17-19). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the method of **Agazzi et al.** with the method of **Temerinac** that included for QAM transmission, the identifying comprising identifying a sequence of samples for which a received signal magnitude in an in-phase component was below a predetermined limit. The artisan would have been motivated because the measured phase and amplitude error values would represent a measure of respective reliability; smaller the error values, greater the reliability.

Agazzi et al. does not expressly teach designating an adjacent sample as a reliable symbol for in-phase. **Temerinac** teaches designating an adjacent sample as a reliable symbol for in-phase (CL3, L17-26), because the measured phase and amplitude error values represent a measure of respective reliability; smaller the error values, greater the reliability (CL3, L17-19). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention

to modify the method of **Agazzi et al.** with the method of **Temerinac** that included designating an adjacent sample as a reliable symbol for in-phase. The artisan would have been motivated because the measured phase and amplitude error values would represent a measure of respective reliability; smaller the error values, greater the reliability.

28. Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Agazzi et al.** (U.S. Patent 5,889,823) in view of **Sakoda et al.** (U.S. Patent 6,590,860).

28.1 As per claim 39, **Agazzi et al.** teaches the method of claim 30. **Agazzi et al.** does not expressly teach the method further comprising assigning weights among the reliable symbols based upon respective reliability factors. **Sakoda et al.** teaches the method further comprising assigning weights among the reliable symbols based upon respective reliability factors (Abstract, L6-10; CL4, L4-7), because that facilitates the transmitted data to be restored with further improved accuracy by conducting a high precision maximum likelihood sequence estimation (Abstract, L17-19). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the method of **Agazzi et al.** with the method of **Sakoda et al.** that included the method further comprising assigning weights among the reliable symbols based upon respective reliability factors. The artisan would have been motivated because that would facilitate the transmitted data to be restored with further improved accuracy by conducting a high precision maximum likelihood sequence estimation.

29. Claims 44, 45 and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Hassan** (U.S. Patent 5,901,185) in view of **Agazzi et al.** (U.S. Patent 5,889,823).

29.1 As per Claims 44 and 48, **Hassan** teaches a receiver, comprising a demodulator to sample and capture transmitted data from a channel (Fig 5, Item 55; CL3, L48-50); a detector and a symbol decoder (Fig. 7, Items 730 and 760).

Hassan does not expressly teach a buffer memory in communication with the demodulator to store the values of captured samples; a processor in communication with the demodulator, executing instructions that establish the logical structures; a reliable symbol detector in communication with the buffer memory, to identify which of the stored captured samples are likely to have been corrupted least by channel effects, the identified samples being reliable symbols; an adaptation unit in communication with the reliable symbol detector to estimate channel effects from the values of the reliable symbols; a symbol decoder unit in communication with the adaptation unit and the buffer memory. **Agazzi et al.** teaches a buffer memory in communication with the demodulator to store the values of captured samples (CL4, L53-54); a processor in communication with the demodulator, executing instructions that establish the logical structures (CL4, L53-54); a reliable symbol detector in communication with the buffer memory (CL2, L19-25), to identify which of the stored captured samples are likely to have been corrupted least by channel effects (CL2, L19-25; CL2, L64 to CL3, L4), the identified samples being reliable symbols (CL2, L19-25); an adaptation unit in communication with the reliable symbol detector (CL6, L34-37; CL6, L59-61), to estimate channel effects from the

values of the reliable symbols (CL6, L26-27; CL8, L25-31; CL8, L36-57); and a symbol decoder unit in communication with the adaptation unit and the buffer memory (CL4, L53-54; CL4, L63 to CL5, L12), because such an apparatus is a typical standard implementation of a digital signal receiver for minimizing intersymbol interference. It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the receiver of **Hassan** with the receiver of **Agazzi et al.** that included a buffer memory in communication with the demodulator to store the values of captured samples; a processor in communication with the demodulator, executing instructions that establish the logical structures; a reliable symbol detector in communication with the buffer memory, to identify which of the stored captured samples are likely to have been corrupted least by channel effects, the identified samples being reliable symbols; an adaptation unit in communication with the reliable symbol detector to estimate channel effects from the values of the reliable symbols; a symbol decoder unit in communication with the adaptation unit and the buffer memory. The artisan would have been motivated because such an apparatus is a typical standard implementation of a digital signal receiver for minimizing intersymbol interference.

29.2 As per claim 45, **Hassan** and **Agazzi et al.** teach the receiver of claim 44. **Hassan** teaches the reliable symbol operates according to a method comprising:

calculating a reliability factor of a candidate sample from values of a plurality of samples proximate to the candidate sample (CL5, L36-40; CL6, L9-11; CL6, L20-24; CL6, L27-30; CL6, L37-44; CL10, L43-53; calculating the reliability factor is same as calculating the quality criteria or bit error probability);

if the reliability factor is less than a predetermined limit, designating the candidate sample as a reliable symbol (CL6, L37-44; CL10, L43-53; designating the candidate sample as a reliable symbol is same as designating the candidate symbol as having associated error probability less than a predetermined threshold).

30. Claim 46 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Hassan** (U.S. Patent 5,901,185) in view of **Agazzi et al.** (U.S. Patent 5,889,823), and further in view of **Dent** (U.S. Patent 6,347,125).

30.1 As per claim 46, **Hassan** and **Agazzi et al.** teach the receiver of claim 45. **Hassan** does not expressly teach that the reliability factor Rn of the candidate sample is given by:

$R_n = \sum_{i=-k1, i \neq 0}^{k2} | y_{n-i} | c_i$, where

y_n, is the candidate sample,

y_{n-i} is a sample in proximity to the candidate sample,

K_1, K_2 are numbers of samples adjacent to the candidate sample, and

c_i is a coefficient i. **Dent** teaches that the reliability factor Rn of the candidate sample is given by:

$R_n = \sum_{i=-k1, i \neq 0}^{k2} | y_{n-i} | c_i$, where

y_n, is the candidate sample,

y_{n-i} is a sample in proximity to the candidate sample,

K_1, K_2 are numbers of samples adjacent to the candidate sample, and

c_i is a coefficient (CL4, L30-41). The motivation for modifying the equalizer of **Hassan** with the method of **Dent** is presented in Paragraph 17.1 above.

31. Claims 49 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Hassan** (U.S. Patent 5,901,185) in view of **Isaksson et al.** (U.S. Patent 6,438,174), and further in view of **Agazzi et al.** (U.S. Patent 5,889,823).

31.1 As per Claim 49, **Hassan** teaches a transmission system comprising a source that transmits data encoded as symbols (Fig 5, Item 500).

Hassan does not expressly teach the symbols being selected from a high-order constellation. **Isaksson et al.** teaches the symbols being selected from a high-order constellation (Abstract, L2-4), because that permits transmission of multiple bits per carrier and symbol (Abstract, L2-4). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the transmission system of **Hassan** with the transmission system of **Isaksson et al.** that included the symbols being selected from a high-order constellation. The artisan would have been motivated because that would permit transmission of multiple bits per carrier and symbol.

Hassan does not expressly teach a destination that captures a signal representing the transmitted symbols having been corrupted by at least intersymbol interference; the destination identifying reliable symbols from the captured samples, the reliable symbols being those captured samples that are estimated to be corrupted least by intersymbol interference; calculating

channel effects based on the reliable symbols and samples proximate thereto; correcting other captured samples based on the channel effects. **Agazzi et al.** teaches a destination that captures a signal representing the transmitted symbols having been corrupted by at least intersymbol interference (CL2, L62 to CL3, L), the reliable symbols being those captured samples that are estimated to be corrupted least by intersymbol interference (CL2, L19-25; CL2, L64 to CL3, L4); the destination identifying reliable symbols from the captured samples (CL2, L19-25); calculating channel effects based on the reliable symbols and samples proximate thereto (CL8, L25-31; CL8, L36-57); correcting the captured samples based on the channel effects (CL3, L6-8; CL8, L25-31; CL8, L36-57), because these are components of the method and apparatus to compensate for linear and non-linear intersymbol interference (CL4, L53-54). It would have been obvious to one of ordinary skill in the art at the time of Applicant's invention to modify the transmission system of **Hassan** with the transmission system of **Agazzi et al.** that included a destination that captured a signal representing the transmitted symbols having been corrupted by at least intersymbol interference; the destination identifying reliable symbols from the captured samples, the reliable symbols being those captured samples that were estimated to be corrupted least by intersymbol interference; calculating channel effects based on the reliable symbols and samples proximate thereto; correcting other captured samples based on the channel effects. The artisan would have been motivated because these would be the components of the method and apparatus to compensate for linear and non-linear intersymbol interference.

31.2 As per claim 50, **Hassan, Isaksson et al.** and **Agazzi et al.** teach the transmission system of claim 49. **Hassan** teaches the reliable symbol operates according to a method comprising:

calculating a reliability factor of a candidate sample from values of a plurality of samples proximate to the candidate sample (CL5, L36-40; CL6, L9-11; CL6, L20-24; CL6, L27-30; CL6, L37-44; CL10, L43-53; calculating the reliability factor is same as calculating the quality criteria or bit error probability);

if the reliability factor is less than a predetermined limit, designating the candidate sample as a reliable symbol (CL6, L37-44; CL10, L43-53; designating the candidate sample as a reliable symbol is same as designating the candidate symbol as having associated error probability less than a predetermined threshold).

32. Claim 51 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Hassan** (U.S. Patent 5,901,185) in view of **Isaksson et al.** (U.S. Patent 6,438,174), and further in view of **Agazzi et al.** (U.S. Patent 5,889,823) and **Dent** (U.S. Patent 6,347,125).

32.1 As per claim 51, **Hassan Isaksson et al.** and **Agazzi et al.** teach the transmission system of claim 50. **Hassan** does not expressly teach that the reliability factor Rn of the candidate sample is given by:

$R_n = \sum_{i=-k1, i\neq 0}^{k2} \mid y_{n-i} \mid c_i$, where

y_n, is the candidate sample,

y_{n-i} is a sample in proximity to the candidate sample,

K_1, K_2 are numbers of samples adjacent to the candidate sample, and

c_i is a coefficient i. **Dent** teaches that the reliability factor Rn of the candidate sample is given by:

$R_n = \sum_{i=-k1, i \neq 0}^{k2} | y_{n-i} | c_i$, where

y_n, is the candidate sample,

y_{n-i} is a sample in proximity to the candidate sample,

K_1, K_2 are numbers of samples adjacent to the candidate sample, and

c_i is a coefficient (CL4, L30-41). The motivation for modifying the equalizer of **Hassan** with the method of **Dent** is presented in Paragraph 17.1 above.

Response to Arguments

33. Applicant's arguments filed on April 21, 2005 have been fully considered. The arguments with respect to 102 (e) and 103 (a) rejections are partly persuasive.

33.1 As per the applicants' argument that "Hassan compares the value of a received bit to a known transmitted value; he does not describe calculating a reliability factor of a sample by considering the values of proximate samples, then comparing it against a predetermined limit", the examiner has used a new reference **Hassan** (U.S. Patent 5,901,185).

Hassan teaches a reliable symbol identification method (CL5, L36-40; CL5, L44-46; CL6, L9-11); comprising:

calculating a reliability factor of a captured sample from values of a plurality of samples in proximity to the captured sample (CL5, L36-40; CL6, L9-11; CL6, L20-24; CL6, L27-30;

CL6, L37-44; CL10, L43-53; calculating the reliability factor is same as calculating the quality criteria or bit error probability);

if the reliability factor is less than a predetermined limit, designating the captured sample as a reliable symbol (CL6, L37-44; CL10, L43-53; designating the captured sample as a reliable symbol is same as designating the captured symbol as having associated error probability less than a predetermined threshold).

33.2 As per the applicants' argument that "Dent does not disclose the mathematics recited in dependent claims 2-5; the sum represented in claim 2 refers to neighboring sample positions (y_{n-i}) in a data stream...; Dent describes operations performed when merging multiple data streams received from different prongs of a RAKE receiver into a common stream; Applicants see no similarity between Dent's system and the claimed invention", the examiner has used a new reference **Dent** (U.S. Patent 6,347,125).

Dent teaches that the reliability factor Rn of the candidate sample is given by:

$R_n = \sum_{i=-k1, i\neq 0}^{k2} | y_{n-i} | c_i$, where

y_n, is the candidate sample,

y_{n-i} is a sample in proximity to the candidate sample;

K_1, K_2 are numbers of samples adjacent to the candidate sample, and

c_i is a coefficient; where $c_i = 1$ for all i; wherein $K_1 = 0$; and wherein $K_2= 0$ (CL4, L30-41), because that allows using the maximum likelihood sequence estimation (MLSE) to hypothesize a

sequence of symbol values using channel coefficients as weighting factors to attempt to predict the received samples (CL4, L43-47).

33.3 As per the applicants' argument that "With respect to claim 6, however, the excerpt cited from Bottomley simply describes a common event that occurs in mobile communication; channel interference conditions change over time; changing channel conditions will lead to changes in the corruption that occurs to candidate samples; it does not provide a suggestion, however, to vary the threshold of claim 6, which determines whether a candidate samples is a reliable symbol", the examiner has used a new reference **Kaasila et al.** (U.S. Patent 6,717,934).

Kaasila et al. teaches that predetermined threshold varies over time (CL3, L61-65; the threshold is varied as a function of noise which varies over time), because that allows determining the magnitude of detection error between the transmitted symbol sequence and the detected symbols and calculating a mean of the detection error powers, comparing the calculated mean of the detection error powers with the threshold value and selecting a modulation type based on the result of comparing (CL3, L56-60).

33.4 As per the applicants' argument that "Isaksson discloses switching between various constellations in certain scenarios; Isaksson does not use the space between any constellation points in a threshold detection system to determine reliability of received samples", the examiner respectfully disagrees.

Isaksson et al. teaches that the predetermined limit is half a width of an annular constellation ring in which the captured sample is observed; and the predetermined limit is $(K_1 + K_2)\ d_{min}$, where d_{min} is half a distance between two constellation points that are closest together in a governing constellation (CL2, L49-51; CL3, L1-2; CL20, L53-57; the maximum allowable symbol error rate is selected from the ratio d/σ), because that allows the system to be adapted to determine a parameter for each carrier, the parameter being indicative of a deviation of the received signal from the corresponding constellation point (Abstract, L6-12).

33.5 As per the applicants' argument that "Verma discloses techniques for peak to average power ratio reduction in transmitters; this has nothing to do with reliable symbol detection; while Verma refers to use of thresholds generally, he has no teaching to use such thresholds in the context of the invention recited in claim 19 - to determine whether a candidate sample can be designated a reliable symbol or not; the limitations of Dent and Verma, described above with respect to claim 19, also apply to claim 25; Dent is directed to decoding of data by RAKE receivers; Verma is directed to an entirely different purpose, management of power ratios in transmitters; these references have nothing to do with each other; they have nothing to do with the subject matter of the claim 25, reliable symbol detection", the examiner has used a new reference **Komatsu** (U.S. Patent 6,560,272).

Komatsu teaches a method of identifying reliable symbols (CL2, L61-63); comprising, for a captured sample:

determining whether any of a plurality of neighboring sample values is within a predetermined limit (CL4, L10-14; CL4, L52-53);

if none of the values exceed the threshold, designating the captured sample as a reliable symbol (CL4, L10-14; CL4, L54-61).

33.6 As per the applicants' argument that "Temerinac discloses detection of timing differences between a transmitter and a receiver; it does not teach or suggest the subject matter of claims 23 or 24, which describe a relationship between a candidate sample and the neighboring captured samples that are relevant to the reliability determination", the examiner respectfully disagrees.

Temerinac teaches that the neighboring samples occur in a first window adjacent to the candidate sample on one side of the candidate sample; and the neighboring symbols occur in a pair of windows that are adjacent to, and on either side of the candidate sample (CL4, L13-24), because if the window extends over several successive symbols or the associated sample values, a very effective reliability value can be determined by a simple logic operation (CL4, L21-24).

33.7 As per the applicants' argument that "**Agazzi** discloses use of a symbol-by-symbol decoder 28 (FIG. 1), which appears to operate on every received symbol in the order in which it was received; **Agazzi** acknowledges in fact that the decisions of the symbol-by-symbol decoder 28 are not reliable and are improved by the concatenated decoder 50; equalizer adaptation is performed based on the results obtained from the symbol-by-symbol decoder 28; **Agazzi** does not estimate which of the captured samples are corrupted least by channel effects and then

calculate the channel effects based on these samples and sample adjacent thereto; neither Temerinac nor Agazzi are directed to the problem of estimating which captured samples are corrupted least by the channel effects and then using these samples - the reliable symbols - to estimate the channel effects and decode the remainder of the samples; Hassan does not disclose an identification of which stored samples are likely to have been corrupted least by channel effects", the examiner takes the position that the Applicants have not described the method of estimating which captured samples are corrupted least by the channel effects. They have only described the method of grouping the symbols as reliable (with error rate within prespecified limit) or not reliable. The examiner has used this interpretation in rejecting the claims.

Agazzi et al. teaches a data decoder (Abstract, L1-3; CL1, L9-12); comprising:

a reliable symbol detector to detect reliable symbols from a sequence of captured samples (CL2, L19-25; CL6, L24-29); the reliable symbols being the captured samples which are estimated to have been corrupted least by intersymbol interference ("ISI") (CL2, L62 to CL3, L4; CL6, L24-29; CL6, L49-53).

Conclusion

34. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Kandasamy Thangavelu whose telephone number is 571-272-3717. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Picard, can be reached on 571-272-3749. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to TC 2100 Group receptionist: 571-272-2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

K. Thangavelu
Art Unit 2123
July 9, 2005